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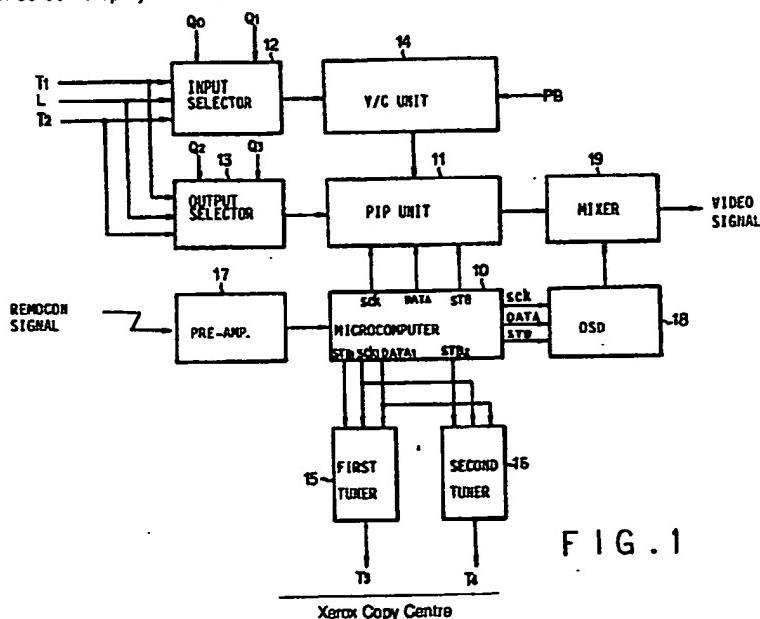
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### (54) Picture-in-picture systems.

(57) A PIP (picture-in-picture) video display system has a luminance/color (Y/C) unit 14 for generating a main screen; a PIP unit 11 for generating a plurality of sub-screens; a microcomputer 10 for controlling the entire system; an input and output selector 12, 13 for selecting image signals under the control of the microcomputer 10; a pre-amplifier 17 for providing a remote control signal as a properly amplified signal to the microcomputer 10; first and second tuners 15, 16 for tuning desired channels; an on-screen-display (OSD) unit 18 for displaying a plurality of skip channel numbers; and a mixer 19 for mixing the PIP screen with the OSD screen to display on the same screen. The system allows a user to be able to configure a desired picture-in-picture screen having a plurality of different images in the different sub-screens, the channels for the sub-screens being selected with the aid of an on-screen display of available channel numbers, from the skip channel OSD unit 18.



## PICTURE-IN-PICTURE SYSTEMS

This invention generally relates to picture-in-picture (PIP) systems, such as are used in, for example, video cassette recorders (hereinafter referred to as VCR) and television sets.

In general, a known PIP system of a VCR displays a certain picture as a main screen and a given number of sub-screens, all of which have the same image source, may be arranged at predetermined positions on the main screen by pressing a PIP key. Upon pressing a PLAY key, the image from the video tape of the VCR will replace the existing main screen, whilst the sub-screens keep on displaying the previous pictures. However, in this circumstance, if a channel UP/DOWN key is input to change the sub-screen display at a user's choice, then all the sub-screens will display the same new picture whilst the main screen displays the existing picture from the VCR tape.

10 Thus, there is a disadvantage that the PIP system displays the same picture on all of the sub-screens.

Preferred embodiments of the present invention aim to provide a multi-screen PIP system which is able to provide a plurality of PIP screens displaying different pictures.

More generally, according to a first aspect of the present invention, there is provided apparatus for controlling a multi-screen video display arranged to display in picture-in-picture (PIP) mode a main screen 15 and a plurality of sub-screens, the apparatus comprising:

first means for receiving a SCREEN PROGRAM signal from a respective user key and, in response to said signal, controlling said video display so as to be in or out of PIP mode;  
second means for generating an on-screen-display (OSD) signal which causes said video display to display a sequence of channel numbers and to indicate selectively a chosen one of said channel numbers;  
20 third means for receiving a channel UP/DOWN signal from a respective user key and, in response to said signal, causing said sequence and/or said chosen one of said channel numbers to be varied;  
fourth means for receiving a ROTATE signal from a respective user key and, in response to said signal, causing an image from the channel of said chosen channel number to be displayed on said video display, such that, in response to successive ROTATE signals initiated by successive activations of the respective  
25 user key, different images from different channels corresponding to different chosen ones of said channel numbers may be displayed successively in different ones of said sub-screens, with said sub-screens then displaying said different images simultaneously.

Said fourth means is preferably arranged to display at least one moving image and a plurality of still images in different ones of said sub-screens.

30 Said second means is preferably arranged to indicate selectively a chosen one of said channel numbers by causing said chosen channel number to flash or flicker on said video display.

The apparatus may be arranged to perform the following steps:

(a) outputting rotation data from a microcomputer to perform a strobe-stop, upon receipt of said SCREEN PROGRAM signal;  
35 (b) checking whether said channel UP/DOWN signal is received by calling a skip channel on-screen-display in the strobe-step condition, increasing a pointer value if said channel UP/DOWN signal is received, selecting a channel presently flickering if said UP/DOWN signal is not received but said ROTATE signal is received, and thereupon outputting the rotation data; and  
(c) clearing said skip channel on-screen-display if the SCREEN PROGRAM signal is received while  
40 the ROTATE signal is not received at the step (b) and outputting strobe data to release the strobe-stop condition.

The apparatus may be arranged to call the skip channel on-screen-display by the steps of:

(i) outputting row and column address data and channel number data stored in a skip memory if the skip channel on-screen-display is called, and checking whether said row address is the same as a last address; and  
45 (ii) checking whether a display-on flag is set to "1" if said row address in step (i) is the same as the last address, turning off a channel number on a row corresponding to a value of the sum of the pointer and the row address if said display is in an ON-state, or otherwise turning on the channel number on said row address corresponding to the value of the sum of the pointer and the row address.

50 The apparatus may be arranged to carry out said step (a) by the sub-steps of:

(a1) setting a screen mode flag to "1", checking whether said SCREEN PROGRAM signal is received, and checking repeatedly whether said SCREEN PROGRAM signal is received until said SCREEN PROGRAM signal is detected;  
(a2) checking whether a four picture-in-picture mode is set when the SCREEN PROGRAM signal is received at step (a1), and outputting the rotation data to perform the strobe-stop mode if the four picture-in-

picture mode is set; and

(a3) outputting corresponding four picture-in-picture data if the four picture-in-picture mode is not set at step (a2), and thereupon outputting the rotation data to perform the strobe-stop mode.

The apparatus may be arranged to carry out the step (b) by the sub-steps of:

- 5 (b1) calling the skip channel on-screen-display at the strobe-stop mode and checking whether the channel UP/DOWN signal is received;
- (b2) increasing the pointer value if the channel UP/DOWN signal is received at the step (b1) and re-calling the skip channel on-screen-display; and
- (b3) checking whether the ROTATE signal is received if the channel UP/DOWN signal is not received
- 10 at the step (b1), selecting a corresponding channel which is presently flickering if the ROTATE signal is received, thereupon outputting the rotation data, and then re-calling the skip channel on-screen-display.

The apparatus may be arranged to carry out the step (c) by the sub-steps:

- (c1) checking whether the SCREEN PROGRAM signal is received if the ROTATE signal is not received, and re-executing the step (b) if the SCREEN PROGRAM signal is not received;
- 15 (c2) clearing the skip channel on-screen-display if the SCREEN PROGRAM signal is received at the sub-step (c1); and
- (c3) outputting the strobe data to release the strobe-stop mode and setting the screen mode to "zero".

The invention extends to television, video recorder or other video display apparatus provided with apparatus as above, according to the first aspect of the invention.

In a second aspect, the invention provides a method of controlling a multi-screen video display arranged to display in picture-in-picture (PIP) mode a main screen and a plurality of sub-screens, the method comprising:

- 25 (a) receiving a SCREEN PROGRAM signal from a respective user key and, in response to said signal, controlling said video display so as to be in or out of PIP mode;
- (b) generating an on-screen-display (OSD) signal which causes said video display to display a sequence of channel numbers and to indicate selectively a chosen one of said channel numbers;
- (c) receiving a channel UP/DOWN signal from a respective user key and, in response to said signal, causing said sequence and/or said chosen one of said channel numbers to be varied;
- 30 (d) receiving a ROTATE signal from a respective user key and, in response to said signal, causing an image from the channel of said chosen channel number to be displayed on said video display, such that, in response to successive ROTATE signals initiated by successive activations of the respective user key, different images from different channels corresponding to different chosen ones of said channel numbers may be displayed successively in different ones of said sub-screens, with said sub-screens then displaying
- 35 said different images simultaneously.

Such a method may further comprise one or more of the steps or features disclosed in this specification and/or claims and/or abstract and/or accompanying drawings.

Apparatus in accordance with the invention may comprise a luminance/color (Y/C) unit for generating a main screen; a PIP unit for generating a plurality of sub-screens; a microcomputer for controlling the entire system; an input and output selector for selecting image signals under the control of the microcomputer; a pre-amplifier for providing a remote control signal as a properly amplified signal to the microcomputer; first and second tuners for tuning desired channels; an on-screen-display (OSD) unit for display a plurality of skip channel numbers; and a mixer for mixing the PIP screen with the OSD screen to display on the same screen.

45 For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 is a block diagram of one example of a PIP system embodying the invention in a VCR;

Figures 2A-2H are screen status diagrams illustrating examples of operation of the system of Figure

- 1:
- 50 Figure 3 is a flow chart illustrating an example of the overall operation of the system;
- Figure 4 is a flow chart illustrating one example of a procedure for displaying channel status; and
- Figure 5 is a flow chart illustrating one example of a procedure for flickering a skip channel on-screen-display (OSD).

Referring now to Figure 1, a signal from a remote controller (not shown) is amplified by a pre-amplifier 17 and applied to a microcomputer 10. The microcomputer 10 decodes the received signal to determine which key of the remote controller has been pressed. First and second tuners 15, 16 are used to perform a picture-in-picture operation, and make it possible to configure a multi-screen display freely as a user desires. Selection of the first or the second tuner 15, 16 is controlled via first and second strobe terminals

STB<sub>1</sub> and STB<sub>2</sub> of the microcomputer 10. Data output from a data terminal DATA<sub>1</sub> of the microcomputer 10 affects the channel to be selected.

Output terminals T<sub>3</sub>, T<sub>4</sub> of the first and second tuners 15, 16 are connected respectively to input terminals T<sub>1</sub>, T<sub>2</sub> of input and output selectors 12, 13. A line L connected to both of the input and the output 5 selectors 12, 13 is used to connect external equipment to the VCR. Each of the input and output selectors 12, 13 is controlled by given data Q<sub>0</sub>, Q<sub>1</sub> and Q<sub>2</sub>, Q<sub>3</sub> generated from the microcomputer 10 to select one of the signals applied from the input terminals T<sub>1</sub>, T<sub>2</sub> and the line L. The input selector 12 is used to select a main screen, while the output selector 13 is used to select sub-screens.

The signals selected by the input and output selectors 12, 13 are applied to a luminance/color (Y/C) unit 10 14 and a picture-in-picture (PIP) unit 11, respectively.

The Y/C unit 14 is used to create the main screen. The signals selected for the main screen by the input selector 12 will be a first screen image source from the first tuner 15 if a playback (PB) key is not 15 input, and an image source from tape if the playback key (PB) is input.

The main screen and the sub-screen selected by the input and output selectors 12, 13 are applied to 15 the PIP unit 11. The PIP screen generated under the control of signals from clock SCK, data DATA and strobe STB terminals of the microcomputer 10 is applied into a mixer 19. An On-Screen-Display (OSD) 18 displays characters under the control of signals from the clock SCK, data DATA and strobe STB terminals of the microcomputer 10. The character data is sent to the mixer 19 to be superimposed upon the screen. The mixer 19 superimposes the characters upon the screen to provide a video signal output.

20 The PIP unit 11 is controlled by exchanging data in series with the microcomputer 10. As is shown in Table 1 hereinbelow, if the microcomputer 10 outputs the data (0000 0010), the PIP unit 11 performs a rotation function.

Table 1

25

30

35

DATA	FUNCTION
0000 0010	rotation
0010 1111	strobe
.	.
.	.
.	.

Upon pressing a ROTATE key (for example, in a 4-PIP system), the microcomputer will stop strobing. To achieve this strobe-stop condition, the strobe data should be output in series to the PIP unit 11 from the 40 microcomputer 10. To configure the PIP screen, it is necessary to press a SCREEN PROGRAM key, when the screen display has the normal condition illustrated in Figure 2A.

Thus, upon pressing the SCREEN PROGRAM key, strobing will be stopped and, as shown in the example of Figure 2B, a skip channel is displayed by the OSD 18, such that the upper-most channel number flickers. Strobing transfers the position of the moving screen in a given direction, rotationally. Only 45 one of the four sub-screens is a moving screen, while the others remain as still screens. The strobe-stop state is the state where the system remains in one of the strobing states, i.e., any one of the four sub-screens is a moving screen and the others are still screens. In addition, a skip channel represents a channel that is available for actual broadcasting. A memory which stores the skip channel numbers is called a skip memory.

As shown in Figure 2B, the upper-most channel number flickers in the respective strobe-stop state. 50 Thereafter, pressing a channel UP/DOWN key changes the channel number that is flickering. Upon pressing the channel UP/DOWN key for a lower channel when the lower-most channel 9 is flickering, channel 2 will disappear and as, shown in Figure 2C, channel 11, the next channel in the skip memory, will be displayed.

The following is a description of how a screen comprised of four channel-7 screens is changed to one 55 comprised of channels 2, 7, 9, and 11. From the condition as shown in Figure 2A, pressing the SCREEN PROGRAM key results in the condition shown in Figure 2D. Upon pressing the ROTATE key, the moving sub-screen currently at a first location (top left) is changed to the flickering channel 2 and is transferred to a second location (top right). As shown in Figure 2E, the first location is configured with the channel 2.

Thereafter, in order to configure the second location with channel 7, executing a rotation, or pressing

the ROTATE key after making the channel 7 flicker by using the channel UP/DOWN key for a lower channel as shown in Figure 2E, results in the configuration of Figure 2F.

Configuring a third location (bottom right) with channel 9 and a fourth location with channel 11 is carried out in the same way as the configuration procedures for the first and second locations. The resulting 5 screens are depicted in Figures 2G and 2H, respectively.

Pressing the SCREEN PROGRAM key to leave the screen program mode releases the strobe-stop. Then, the channels configured by the user will be displayed and the OSD display for the skip channel will disappear.

The screen program function will now be described by referring to the flow diagram in Figure 3. At step 10 1a, "1" is assigned to the screen mode flag and at step 1b, the microcomputer 10 checks whether the SCREEN PROGRAM key is pressed. If it is pressed, strobing will be stopped and step 1c will be executed. Otherwise, the step 1b will be repeated.

At the step 1c, the microcomputer 10 checks for 4-PIP screen mode. If 4-PIP screen mode is selected, step 1d will be executed. Otherwise, step 1e will be executed. At step 1d, the rotation data will be output 15 and step 2a will be executed. The 4-PIP data will be output at step 1e and the rotation data will be output at step 1f; then the step 2a will be executed.

Step 2a calls the skip channel OSD and step 2b checks whether the channel UP/DOWN key is pressed. If it is pressed, the skip memory pointer value will be increased by a designated value and the step 2a will be performed again. If it is not pressed, whether the ROTATE key is pressed will be checked at step 2d. If 20 the ROTATE key is pressed, step 2e will be executed or, otherwise, step 3a will be executed. The channel which is flickering on the skip channel OSD 18 is selected at the step 2e and then step 2f will be performed. At the step 2f, the rotation data is generated and then step 2a is executed again.

At the step 3a, whether the SCREEN PROGRAM key is pressed will be checked. If it is not pressed, the step 2a will be executed again. Otherwise, it clears the skip channel OSD 18 at step 3b and executes 25 step 3c. The strobe-stop condition that outputs the strobing data will be released at the step 3c and then step 3d will be executed. At the step 3d, the screen mode flag will be set to "0" to complete the procedure.

Figure 4 shows a flow diagram for indicating the channel on the screen, wherein the following steps will be executed upon calling the skip channel OSD 18 at the step 2a. The skip channel OSD 18 will be called and the data for row address and column address will be output at step 4b and then step 4c will be 30 performed. The step 4c outputs the channel number data stored in the skip memory and step 4d increases the row address. Then step 4e will be executed. At the step 4e, whether the row address is the same as a last address will be checked. If it is not the same as the last address, the step 4b will be executed again. If it is the last address, step 4f will be executed. The step 4f checks whether display-on flag DSPON is set to "1". If it is not "1", step 4g will be executed. If it is "1", step 4g will be performed.

35 At the step 4g, the line corresponding to the pointer value which is added with the row address will be turned off to return. At the step 4h, the line corresponding to the pointer value plus the row address will be turned on to return to the main procedure.

Figure 5 shows a flow diagram to show the time for the skip channel flickering interval. Step 5b checks whether the screen mode is "1" or not. If it is "1", step 5c will be executed. If not "1", step 5f will be 40 performed. The step 5c checks whether the display-on flag DSPON is set to "1" or not. If it is not "1", the display-on flag DSPON is set to "1" at step 5d and then returns. If it is "1", the display-on flag DSPON is set to "0" at step 5e and then returns. At the step 5f, the general timer operates for a predetermined period and then returns.

As described above, for each designated screen channel memorized on the PIP screen, the user 45 directly configures the desired PIP screen using the skip channel OSD. Therefore, the user is provided with various PIP screens which may show different channels, rather than all the same one.

While a preferred embodiment of the invention has been particularly shown and described above, this is just an example, and it will be understood by those skilled in the art that modifications may be made without departing from the spirit and scope of the invention.

50 The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any 55 combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example

only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps 5 of any method or process so disclosed.

### Claims

- 10 1. Apparatus for controlling a multi-screen video display arranged to display in picture-in-picture (PIP) mode a main screen and a plurality of sub-screens, the apparatus comprising:  
first means (17,10,11) for receiving a SCREEN PROGRAM signal from a respective user key and, in response to said signal, controlling said video display so as to be in or out of PIP mode;  
second means (10,18) for generating an on-screen-display (OSD) signal which causes said video display to display a sequence of channel numbers and to indicate selectively a chosen one of said channel numbers;  
third means (17,10,18) for receiving a channel UP/DOWN signal from a respective user key and, in response to said signal, causing said sequence and/or said chosen one of said channel numbers to be varied;  
fourth means (17,10,15,16,12,13) for receiving a ROTATE signal from a respective user key and, in response to said signal, causing an image from the channel of said chosen channel number to be displayed on said video display, such that, in response to successive ROTATE signals initiated by successive activations of the respective user key, different images from different channels corresponding to different chosen ones of said channel numbers may be displayed successively in different ones of said sub-screens, with said sub-screens then displaying said different images simultaneously.
- 25 2. Apparatus according to claim 1, wherein said fourth means is arranged to display at least one moving image and a plurality of still images in different ones of said sub-screens.
- 30 3. Apparatus according to claim 1 or 2, wherein said second means is arranged to indicate selectively a chosen one of said channel numbers by causing said chosen channel number to flash or flicker on said video display.
- 35 4. Apparatus according to claim 3, arranged to perform the following steps:  
(a) outputting rotation data from a microcomputer to perform a strobe-stop, upon receipt of said SCREEN PROGRAM signal;  
(b) checking whether said channel UP/DOWN signal is received by calling a skip channel on-screen-display in the strobe-step condition, increasing a pointer value if said channel UP/DOWN signal is received, 35 selecting a channel presently flickering if said UP/DOWN signal is not received but said ROTATE signal is received, and thereupon outputting the rotation data; and  
(c) clearing said skip channel on-screen-display if the SCREEN PROGRAM signal is received while the ROTATE signal is not received at the step (b) and outputting strobe data to release the strobe-stop condition.
- 40 5. Apparatus according to claim 4, arranged to call the skip channel on-screen-display by the steps of:  
(i) outputting row and column address data and channel number data stored in a skip memory if the skip channel on-screen-display is called, and checking whether said row address is the same as a last address; and
- 45 (ii) checking whether a display-on flag is set to "1" if said row address in step (i) is the same as the last address, turning off a channel number on a row corresponding to a value of the sum of the pointer and the row address if said display is in an ON-state, or otherwise turning on the channel number on said row address corresponding to the value of the sum of the pointer and the row address.
- 50 6. Apparatus according to claim 4 or 5, arranged to carry out said step (a) by the sub-steps of:  
(a1) setting a screen mode flag to "1", checking whether said SCREEN PROGRAM signal is received, and checking repeatedly whether said SCREEN PROGRAM signal is received until said SCREEN PROGRAM signal is detected;  
(a2) checking whether a four picture-in-picture mode is set when the SCREEN PROGRAM signal is received at step (a1), and outputting the rotation data to perform the strobe-stop mode if the four picture-in-picture mode is set; and  
(a3) outputting corresponding four picture-in-picture data if the four picture-in-picture mode is not set at step (a2), and thereupon outputting the rotation data to perform the strobe-stop mode.
- 55 7. Apparatus according to claim 4, 5 or 6, arranged to carry out the step (b) by the sub-steps of:

- (b1) calling the skip channel on-screen-display at the strobe-stop mode and checking whether the channel UP/DOWN signal is received;
- (b2) increasing the pointer value if the channel UP/DOWN signal is received at the step (b1) and re-calling the skip channel on-screen-display; and
- 5 (b3) checking whether the ROTATE signal is received if the channel UP/DOWN signal is not received at the step (b1), selecting a corresponding channel which is presently flickering if the ROTATE signal is received, thereupon outputting the rotation data, and then re-calling the skip channel on-screen-display.
8. Apparatus according to claim 4, 5, 6 or 7, arranged to carry out the step (c) by the sub-steps:
- (c1) checking whether the SCREEN PROGRAM signal is received if the ROTATE signal is not received, and re-executing the step (b) if the SCREEN PROGRAM signal is not received;
- 10 (c2) clearing the skip channel on-screen-display if the SCREEN PROGRAM signal is received at the sub-step (c1); and
- (c3) outputting the strobe data to release the strobe-stop mode and setting the screen mode to "zero".
- 15 9. Television, video recorder or other video display apparatus provided with apparatus according to any of the preceding claims.
10. A method of controlling a multi-screen video display arranged to display in picture-in-picture (PIP) mode a main screen and a plurality of sub-screens, the method comprising:
- (a) receiving a SCREEN PROGRAM signal from a respective user key and, in response to said signal, controlling said video display so as to be in or out of PIP mode;
- 20 (b) generating an on-screen-display (OSD) signal which causes said video display to display a sequence of channel numbers and to indicate selectively a chosen one of said channel numbers;
- (c) receiving a channel UP/DOWN signal from a respective user key and, in response to said signal, causing said sequence and/or said chosen one of said channel numbers to be varied;
- 25 (d) receiving a ROTATE signal from a respective user key and, in response to said signal, causing an image from the channel of said chosen channel number to be displayed on said video display, such that, in response to successive ROTATE signals initiated by successive activations of the respective user key, different images from different channels corresponding to different chosen ones of said channel numbers may be displayed successively in different ones of said sub-screens, with said sub-screens then displaying
- 30 said different images simultaneously.
11. A method according to claim 10, further comprising one or more of the steps or features disclosed in the foregoing specification and/or claims and/or abstract and/or accompanying drawings.

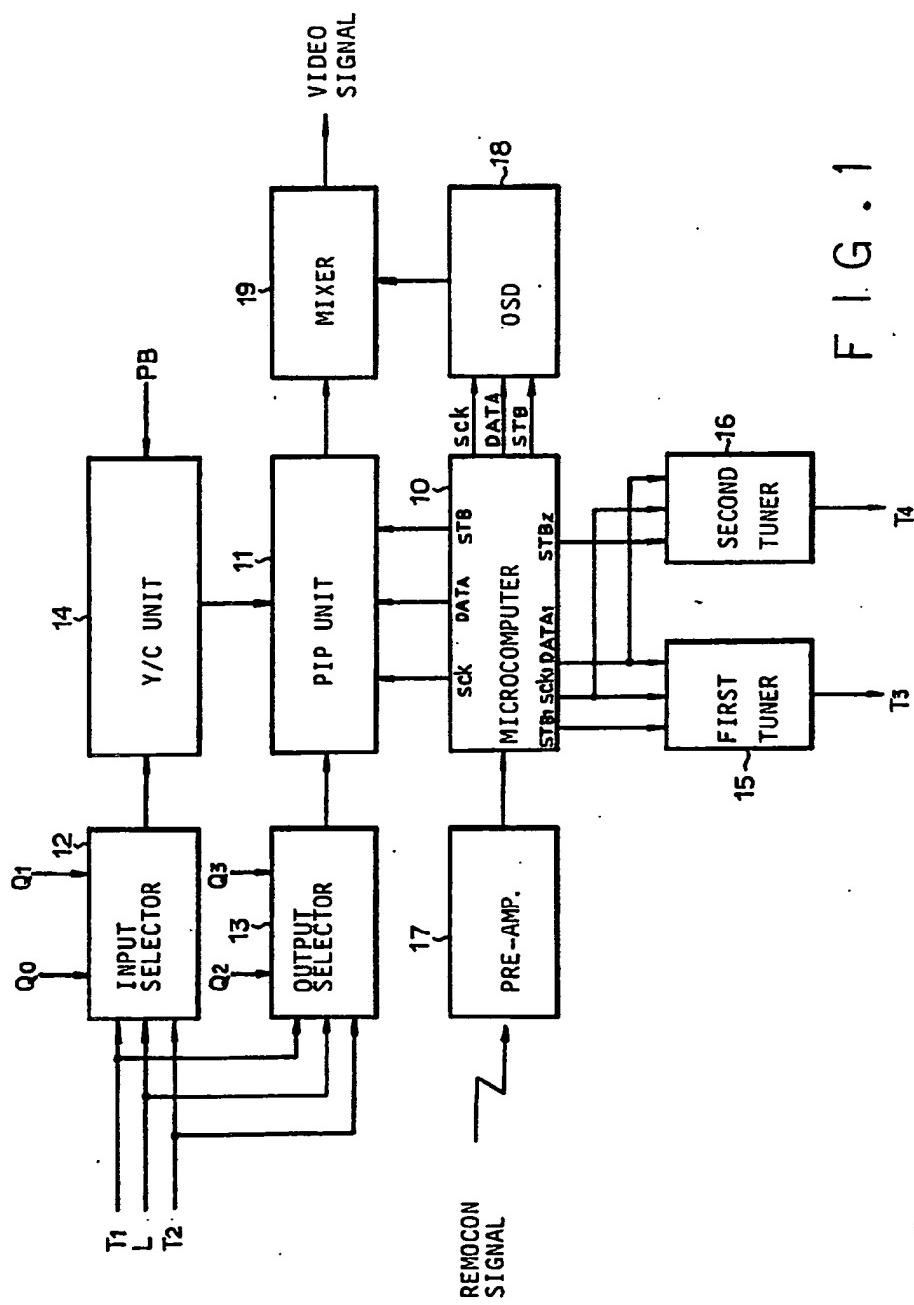
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F I G . 1

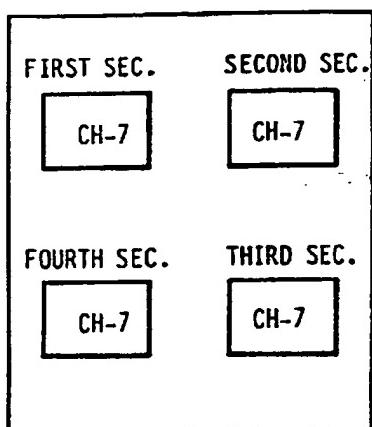


FIG. 2A

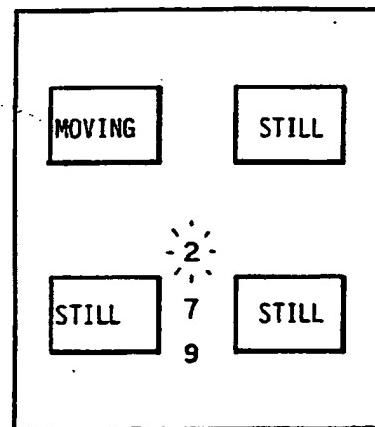


FIG. 2B

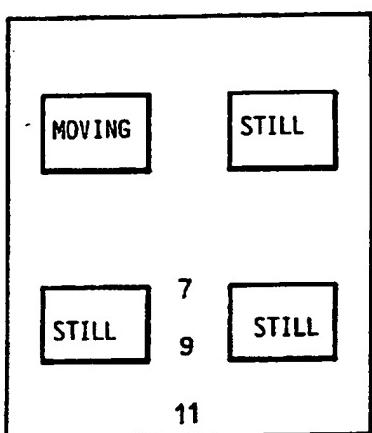


FIG. 2C

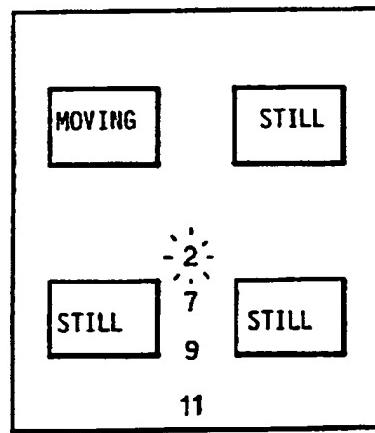


FIG. 2D

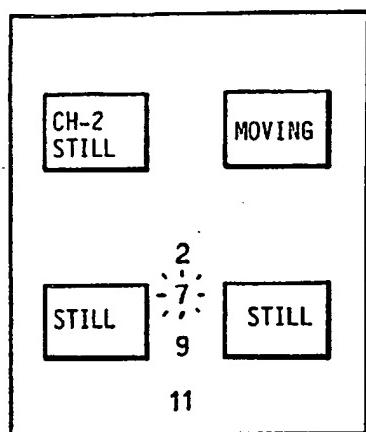


FIG. 2E

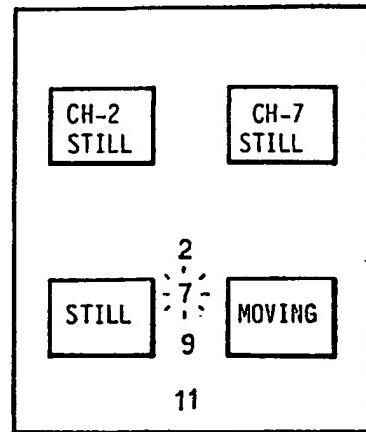


FIG. 2F

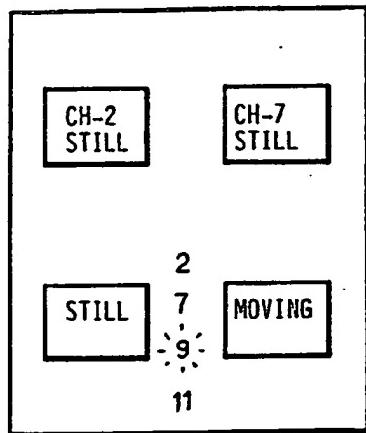


FIG. 2G

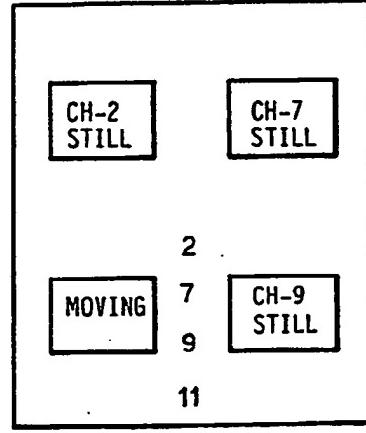


FIG. 2H

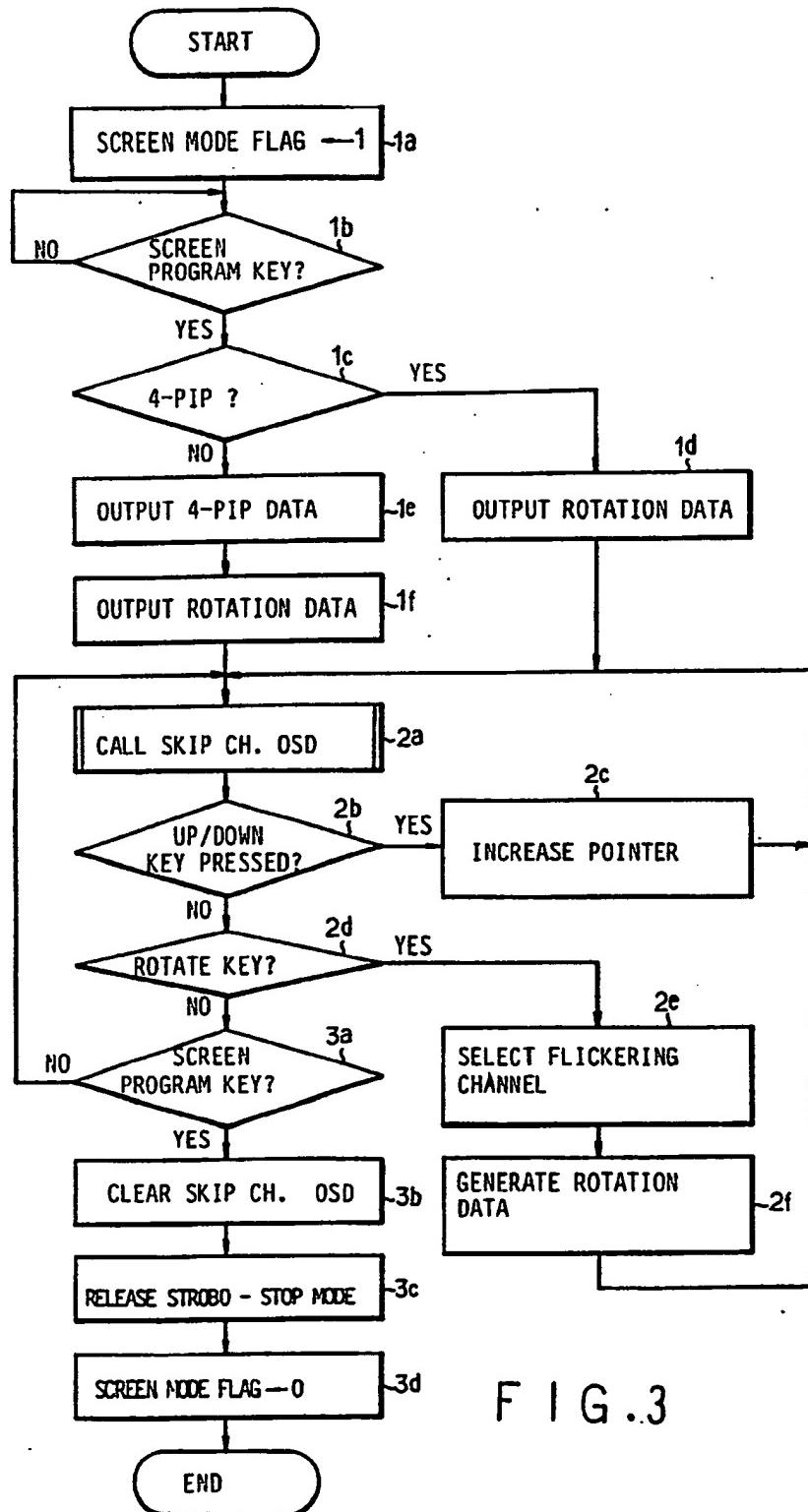


FIG. 3

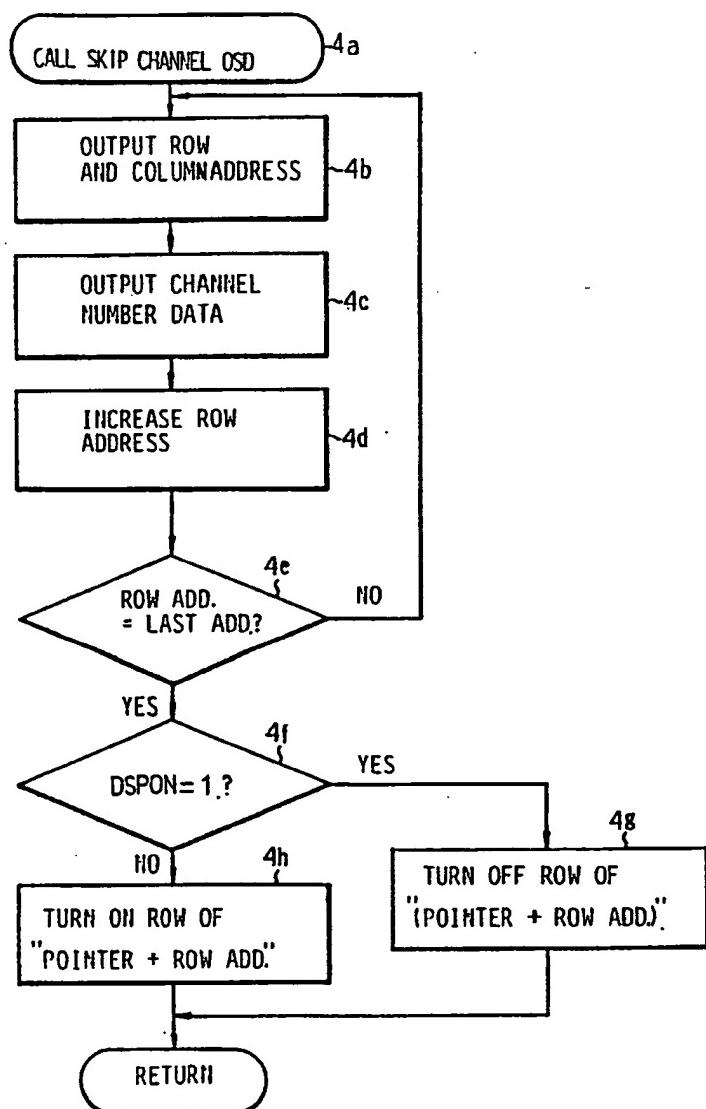
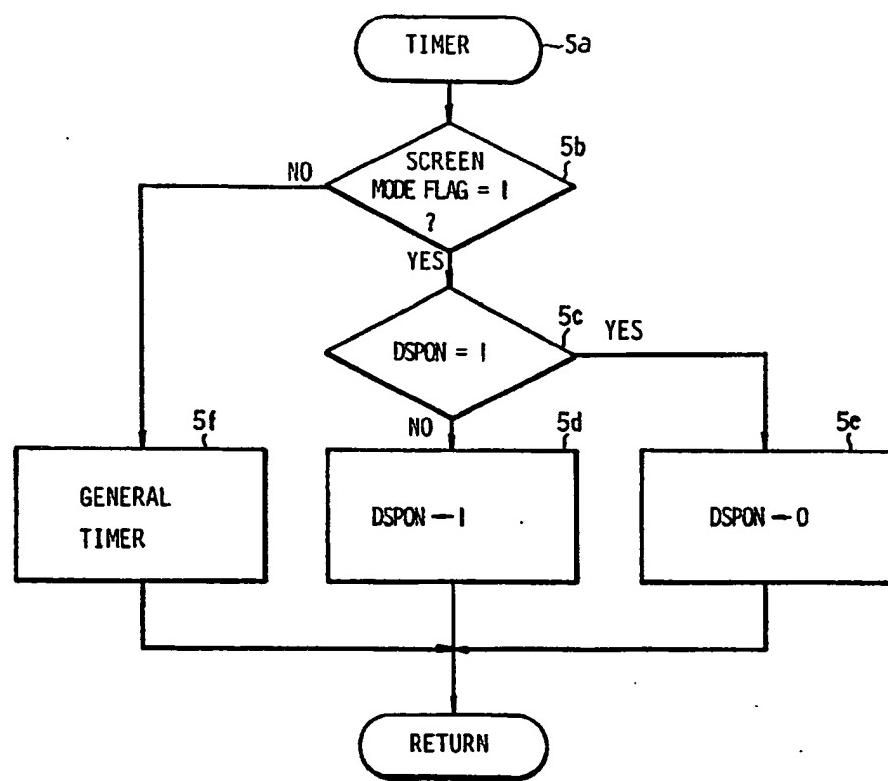


FIG. 4



F I G . 5